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Patent Claims

5 1. An apparatus for determination of the spatial alignment of a semitrailer (6) or trailer which is connected to a prime mover (5), having sensor means (7, 8) which are arranged on the prime mover (5) in order to produce sensor signals which describe the spatial
10 alignment of the semitrailer (6) or trailer relative to the prime mover (5), with the sensor means (7, 8) detecting contours of the semitrailer (6) or trailer, and having an evaluation unit (15) which uses the sensor signals produced by the sensor means (7, 8) to
15 determine at least one angle variable which describes an angle between the prime mover (5) and the semitrailer (6) or trailer,
characterized

20 in that the sensor signals which are produced by the sensor means (7, 8) include image information from a two-dimensional representation (16) and/or an image (16') of a linear subarea of the detected contours of the semitrailer (6) or trailer, and with the evaluation unit (15) determining the at least one angle variable
25 on the basis of the image information by evaluation of the rate of change of geometric characteristics of the two-dimensional representation (16) and/or of the image (16') of the linear subarea of the detected contours of the semitrailer (6) or trailer.

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2. The apparatus as claimed in claim 1,
characterized

in that the evaluation unit (15) determines a first angle variable, which describes an angle (α) between an

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axis which is oriented in the longitudinal direction of the prime mover (5) and an axis which is oriented in the longitudinal direction of the semitrailer (6) or trailer, and/or determines a second angle variable,
5 which describes an angle (β) between an axis which is oriented in the vertical direction of the prime mover (5) and an axis which is oriented in the vertical direction of the semitrailer (6) or trailer.

10 3. The apparatus as claimed in claim 2, characterized in that the evaluation unit (15) determines a first angle rate variable and/or a second angle rate variable, with the first angle rate variable representing the rate of change or derivative of the first angle variable, and the second angle rate variable representing the rate of change or derivative of the second angle variable.

15 4. The apparatus as claimed in claim 2 or 3, characterized in that the evaluation unit (15) uses the first angle variable and/or the second angle variable, and/or the first angle rate variable and/or the second angle rate variable, to determine a mass variable which describes the current mass of the semitrailer (6) or trailer.

20 5. The apparatus as claimed in claim 2 or 3, characterized in that the evaluation unit (15) uses the first angle variable and/or the second angle variable, and/or the first angle rate variable and/or the second angle rate variable, to determine a mass distribution variable, which describes the distribution of the mass along an axis which is oriented in the longitudinal direction of the semitrailer (6) or trailer.

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6. The apparatus as claimed in claim 2 or 3,
characterized

in that the evaluation unit (15) uses the first angle
5 variable and/or the second angle variable, and/or the
first angle rate variable and/or the second angle rate
variable, to determine a center of gravity height
variable, which describes the height of the center of
gravity of the semitrailer (6) or trailer.

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7. The apparatus as claimed in claims 4 and 5,
characterized

in that the evaluation unit (15) determines a threshold
value for the first angle variable and/or for the first
15 angle rate variable as a function of the mass variable
and of the mass distribution variable, with the
evaluation unit (15) appropriately influencing drive
means (26) and/or braking means (28) and/or steering
means (30) for the prime mover (5) and/or braking means
20 (36) in the semitrailer (6) or trailer in order to
prevent the magnitude of the first angle variable
and/or of the first angle rate variable exceeding the
respectively determined threshold value.

25 8. The apparatus as claimed in claim 7,
characterized

in that the evaluation unit (15) produces a driver
warning if the difference between the magnitude of the
first angle variable and/or between the magnitude of
30 the first angle rate variable and the respectively
determined threshold value is less than a respectively
predetermined limit value.

35 9. The apparatus as claimed in claim 7 or 8,
characterized
in that the evaluation unit (15) determines the

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threshold value for the first angle variable and/or for the first angle rate variable taking into account the instantaneous driving state of the prime mover (5).

5 10. The apparatus as claimed in claims 4 and 6,
characterized

in that the evaluation unit (15) determines a threshold value for the second angle variable and/or for the second angle rate variable as a function of the mass 10 variable and of the center of gravity height variable, with the evaluation unit (15) appropriately influencing drive means (26) and/or braking means (28) and/or steering means (30) for the prime mover (5), and/or braking means (36) in the semitrailer (6) or trailer, 15 in order to prevent the magnitude of the second angle variable and/or the magnitude of the second angle rate variable exceeding the respectively determined threshold value.

20 11. The apparatus as claimed in claim 10,
characterized

in that the evaluation unit (15) produces a driver warning if the difference between the magnitude of the second angle variable and/or between the magnitude of 25 the second angle rate variable and the respectively determined threshold value is less than a respectively predetermined limit value.

12. The apparatus as claimed in claim 10 or 11,
30 characterized

in that the evaluation unit (15) determines the threshold value for the second angle variable and/or for the second angle rate variable taking into account the instantaneous driving state of the prime mover (5).

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13. The apparatus as claimed in claims 4 and 5,

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characterized

in that the evaluation unit (15) determines a nominal value for the first angle variable and/or for the first angle rate variable as a function of the mass variable
5 and of the mass distribution variable, with the evaluation unit (15) appropriately influencing drive means (26) and/or braking means (28) and/or steering means (30) for the prime mover (5) and/or braking means (36) in the semitrailer (6) or trailer in order to
10 allow the first angle variable and/or the first angle rate variable to assume the respectively determined nominal value.

14. The apparatus as claimed in claim 13,
15 characterized

in that the evaluation unit (15) determines the nominal value for the first angle variable and/or for the first angle rate variable taking into account the instantaneous driving state of the prime mover (5).

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15. The apparatus as claimed in claim 13 or 14,
characterized

in that means (55, 56) are provided for detection of the roadway profile, with the evaluation unit (15)
25 taking into account the detected roadway profile in the determination of the nominal value of the first angle value and/or of the nominal value of the first angle rate variable.

30 16. The apparatus as claimed in claims 4 and 6,
characterized

in that the evaluation unit (15) determines a nominal value for the second angle variable and/or for the second angle rate variable as a function of the mass variable and of the center of gravity height variable,
35 with the evaluation unit (15) appropriately influencing

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drive means (26) and/or braking means (28) and/or steering means (30) for the prime mover (5), and/or braking means (36) in the semitrailer (6) or trailer, in order to ensure that the second angle variable 5 and/or the second angle rate variable assumes the respectively determined nominal value.

17. The apparatus as claimed in claim 16, characterized

10 in that the evaluation unit (15) determines the nominal value for the second angle variable and/or for the second angle rate variable taking into account the instantaneous driving state of the prime mover (5).

15 18. The apparatus as claimed in claims 16 or 17, characterized

in that means (55, 56) are provided for detection of the roadway profile, with the evaluation unit (15) taking into account the detected roadway profile in the 20 determination of the nominal value of the second angle variable and/or of the nominal value of the second angle rate variable.

19. The apparatus as claimed in claim 2 or 3, 25 characterized

in that means (55, 56) are provided for detection of the spatial alignment and/or of the dynamic response of the prime mover (5) relative to the contours of the roadway, with the evaluation unit (15) using the 30 detected spatial alignment and/or the detected dynamic response of the prime mover (5) relative to the contours of the roadway to determine the spatial alignment and/or the dynamic response of the vehicle combination and/or of the semitrailer (6) or trailer 35 relative to the contours of the roadway by taking into account the first angle variable and/or the second

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angle variable, and/or the first angle rate variable and/or the second angle rate variable.

20. The apparatus as claimed in claim 1,
5 characterized
in that the sensor means (7, 8) comprise an arrangement
of imaging sensors, which are designed to detect
electromagnetic waves in the visible or invisible
optical wavelength range or in the radar wavelength
10 range.

21. The apparatus as claimed in claim 1,
characterized
in that the sensor means (7, 8) are part of a blind-
15 angle monitoring device or of a rear-area monitoring
device.

22. The apparatus as claimed in claim 2 or 3,
characterized
20 in that the first angle variable and/or the first angle
rate variable, and/or the first angle rate variable
and/or the second angle rate variable are used to
provide a parking aid and/or a reversing aid.

25 23. A method for determination of the spatial
alignment of a semitrailer (6) or trailer which is
connected to a prime mover (5), in which sensor signals
are produced which describe the spatial alignment of
the semitrailer (6) or trailer relative to the prime
mover (5) with contours of the semitrailer (6) or
30 trailer being detected in order to produce sensor
signals, and in which the sensor signals which are
produced are used to determine at least one angle
variable which describes an angle between the prime
mover (5) and the semitrailer (6) or trailer,
35 characterized

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in that the sensor signals which are produced include image information from a two-dimensional representation (16) and/or an image (16') of a linear subarea of the detected contours of the semitrailer (6) or trailer,
5 with the at least one angle variable being determined on the basis of the image information by evaluation of the rate of change of geometric characteristics of the two-dimensional representation (16) and/or of the image (16') of the linear subarea of the detected contours of
10 the semitrailer (6) or trailer.